THE TINEIDS OF NORTH AMERICA.* — Our gratitude is due to Mr. Stainton for this kindly act of international courtesy in preserving in a permanent form the part of Dr. Clemens' scientific writings (and they were all confined to the Lepidoptera) relating to the family of Tineidæ. Dr. Clemens was fortunate in the beginning of his studies, in the friendship of so able a naturalist and kind a helper as the editor. For our part, who owe so many favors to Dr. Clemens, and also have derived so much aid and stimulus from Mr. Stainton's works, we appreciate fully this mark of friendship.

Little new matter, but a number of new woodcuts appear, from Dr. Clemens' pencil, being mostly outlines of the venation of the wings of these small moths. Nine letters to Mr. Stainton, and a few pages of other matter, are added to what has already been published in the Proceedings of the Academy of Natural Sciences, and the Entomological Society of Philadelphia.

BOTANY.

ON CROSS-FERTILIZATION AS AIDED BY SENSITIVE MOTION IN MUSK AND ACHIMENES.— The sensitive motion of *Mimulus* has been well known, at any rate, since the time of Sprengel, who curiously enough includes this proper motion among those to account for which he says "we are obliged to suppose an internal impulse, a force independent of external influences.† In this category he places the stigmatic movements of *Mimulus*, *Martynia*, and *Scævola*, and the movements of the stamens in *Parnassia* and other plants. The object of the movements of the stamens in *Parnassia* was already connected in his mind with that of insect agency, and this has since been conclusively established by other botanists.‡

I am not aware that a like connection has been noticed between the stigmatic movements of musk, and the necessity of insect fertilization. Vaucher remarks that during *the time of fecundation* *M. luteus* and *M. glutinosus* will, as he himself has tried, close at

* The Tineina of North America, by the late Dr. Brackenridge Clemens. (Being a collected edition of his writings on that group of insects.) With notes by the editor, H. T. Stainton, F. R. S., London, 1872. John Van Voorst, 8vo, pp. 282, with woodcuts.

† Sprengel's "Anleitung zur Kenntniss der Gewächse," part i, p. 274.

‡ See A. W. Bennett's paper in Journ. Linn. Soc., vol. xi, p. 26.

the slightest touch. The sensitiveness will be seen to play a useful part in this fecundation.

I will take the commonest species, *M. moschatus*, as a type. The flowers vary from erect in the bud to horizontal in the full blown flower, but never hang downwards. Of the four stamens the anterior, lower, and larger pair ripen after the posterior, upper, and shorter pair. Both pairs of anthers are held together by hairs, and the longitudinal slits of the anther open towards the lower lip, and away from the base of the flower. The style is closely pressed against the upper lip of the corolla, and its stigma has two large flat fan-shaped lobes. In a very young bud these lobes are closed. In a hardly opened bud the lobes are beginning to open, the lower one bending back against the style; at this time it is that the shorter stamens burst, but as they are much shorter than the style the pollen cannot reach the stigma, and its course down the tube is facilitated by the, at that time, slanting position of the flower. In a just opened flower the stigmas are fully open, parallel, and opposite to the lower lip of the corolla, its viscous surfaces being therefore both downwards; the shorter anthers are nearly empty, and the longer only just beginning to split; the pistil is therefore synacmic with the shorter, and almost protogynous with respect to the longer stamens.

In a flower almost beginning to fade the longer stamens are still shedding their pollen, the shorter ones are withered, and the stigma be-pollened and in many cases closed. This closing may, moreover, be experimentally produced by touching the stigmatic surface with a pencil, in which case the stigmas will close in about thirty seconds. In faded flowers, whether from contact or otherwise, the stigmatic surfaces have closed.

From these facts it will appear that self-fertilization by the shorter stamens is impossible, and that it is rendered improbable by the longer stamens (1) by their bursting late; (2) by the direction in which the anthers open; (3) by their not reaching as far as the stigmas, and, as being anterior, by being some slight distance from the upper lip; (4) from the probability that the stigmatic surfaces may have been touched and closed before they burst at all.

On the other hand, an insect attracted to the flower for the honey could hardly leave the flowers without some pollen on the upper side of his body or on his proboscis. The hairs which hold

the anthers together no doubt facilitate this, as they do in *Pedicularis*, by keeping the stamens from separating. The large size of the stigmatic surface will of course increase the chance that any insect with pollen on its proboscis or back will not fail to leave some grains attached to it as he works his way towards the bottom of the flower.

But what purpose does the sensitiveness serve? To prevent the stigma being fertilized by its own pollen by insect agency. Without this sensitiveness why should not an insect covered with the pollen of the shorter and synacmic stamens leave the pollen on the stigma of the same plant as he backs his way out? Given the sensitiveness, this is impossible, for as the insect passes under the stigma the sensitive motion is excited, and while he is drinking the honey time is allowed for its completion, or if it be not completed in time, the mechanical effect of the backing motion of the insect will be to complete the closing.

A similar use of a quite different movement has been suggested to me by Miss S. S. Dowson, one of my Cambridge corresponding class. The *Achimenes* (Gesneraceæ) has a tubular corolla five-cleft with a swelling just below the top of the throat. There are four perfect stamens, not much differing in length, and the stigma is ultimately two-cleft. In the bud the pistil is much shorter than the stamens, but by the time the bud is just opened it has lengthened out between the stamens, and its tip is adpressed to the upper lip of the corolla. As yet the stigma has its two branches closely folded together. The anthers at this time are all four close beneath the end of the pistil, and open downwards. The filaments then begin to contract, and the anthers, which adhere together, are drawn lower; and finally the filaments twist themselves up to such a degree that the anthers are drawn down to the very base of the tube. The object of this is clearly to get them out of the way of the stigma, for during the process the pistil has arched forwards and downwards, and the two branches of the stigma have opened. They will be seen to form a fork over a slight rising in the middle lip of the corolla, by which entrance to the flower, except exactly under the stigmatic surfaces, is prevented.—F. E. KITCHENER *in Trimen's Journal of Botany.*

NARDOSMIA PALMATA.—Looking over the NATURALIST for April, 1872, I find this plant mentioned by Prof. Tenney, as occurring in

Amherst, Mass. with the query "What are the New England localities of this rare plant?" During 1859–60 I found it in the vicinity of Bangor, Me., on land newly cleared and burnt over, growing as abundantly as erechthites or any of the "fire weeds," many acres being entirely covered with it.

Making a trip subsequently to Mt. Katahdin, nearly one hundred miles north from Bangor, I found it abundantly, at intervals, in clearings, all along the route. But I have never found it elsewhere in New England.—J. W. CHICKERING.

[It is known to occur in Brunswick, Maine.—EDITORS.]

THE USES AND ORIGIN OF THE ARRANGEMENTS OF LEAVES IN PLANTS.—A paper by Chauncey Wright, with the above caption, appears in the last part (vol. ix, part ii) of the Memoirs of the American Academy of Arts and Sciences. It is a philosophical and exceedingly interesting discussion of the subject, and we shall endeavor to bring it to the notice of our readers in a subsequent number.

ZOOLOGY.

SPONTANEOUS DIVISION IN STARFISHES.—Mr. C. Lütken, of Copenhagen, so well known for his important researches on the natural history of certain groups of the Echinoderms, has recently laid before the Royal Academy of Copenhagen the results of some very interesting and valuable investigations on the spontaneous division of the starfishes and brittle-stars. Professor Verrill has recently described a new genus of brittle-star (*Ophiothela*), all the known species of which possess a number of arms greater or less than five, generally six, and in some few instances three or two; very rarely indeed does the normal number of five make its appearance. Lütken describes a new species of this genus (*O. isidicola*) on a certain number of specimens of which he finds six nearly equal arms, but in the majority of these specimens there is a marked difference between the three arms on one side of the body and the three arms on the other; in another set the difference is still more marked, the one set of three arms being quite small and the other of the ordinary size. In others, again, this difference is extended to the disk itself, and it looks as if it had been cut in two by a knife. In all these cases there can be little doubt that these appearances result from a primary division and then a regeneration